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Vol. XXXIX. No. 4.

REPORTS ON THE SCIENTIFIC RESULTS OF THE EXPEDITION TO THE TROPICAL PACIFIC, IN CHARGE OF ALEXANDER AGASSIZ, BY THE U. S. FISH COMMISSION STEAMER "ALBATROSS," FROM AUGUST, 1899, TO MARCH, 1900, COMMANDER JEFFERSON F. MOSER, U. S. N., COMMANDING.

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XXXIII.

HOLOTHURIOIDEA.

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COMP. ZOÖLOGY.
CAMBRIDGE, MASS.

By HUBERT LYMAN CLARK.

WITH FOUR PLATES.

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CAMBRIDGE, U. S. A.:
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TROPICAL PACIFIC HOLOTHURIOIDEA.

INTRODUCTION

The number of holothurians collected by the Albatross on her Tropical Pacific expeditions was not large and hence a single report is preferable. Those taken in 1899–1900 were originally sent to Professor Mitsukuri at Tokyo and he had made numerous notes, prepared many slides, and identified many of the species before his failing health put an end to his work. Later the collection was received at Cambridge. The collections of 1904–1905 were sent to Professor Ludwig at Bonn but his death occurred before he had made any identifications and the material was forwarded to Cambridge in the spring of 1914.

The earlier collection is a small one, consisting of only fifty-nine specimens, representing sixteen species, and eleven are common, wide-spread Indo-Pacific littoral forms. Of the remaining five, two appear to be species hitherto unknown.

Expedition 1899–1900 — List of Species — (New Species indicated by an *).

Synapta maculata.
Pseudocucumis africana.
Pelagothuria natatrix.
*Peniagone bispiculata.
Peniagone vitrea.
Euphronides verrucosa.
*Mesothuria multipora.
Stichopus chloronotus.
Holothuria atra.
Holothuria difficilis.
Holothuria impatiens.
Holothuria leucospilota.
Holothuria monocaria.
Holothuria pardalis.
Holothuria scabra.
Actinopyga mauritiana.

The collection of 1904–1905 is a much larger and more interesting one, containing 218 specimens of forty-three species, of which eleven are described as new and only a dozen are well-known littoral forms. There are also half a dozen additional specimens, which owing to their condition are quite unidentifiable; they seem to represent three species of Elpidiidae; one is probably referable to Euphronides while the others are apparently Psychropotes.

Expedition 1904–1905 — List of Species — (New Species indicated by an *).

Protankyra abyssicola.
*Chiridota aponocrita.
Chiridota rigida.
*Myriotrochus bathybius.
*Myriotrochus giganteus.
*Molpadia bathybia.
Molpadia holothurioides.
Ceraplectana trachyderma.
Cucumaria abyssorum.
Echinocucumis bitentaculata.
Pelagothuria natatrix.
*Parelpidia anamesa.
Scotoplanes murrayi.
*Periamma tetramerum.
Peniagone intermedia.
Peniagone setosa.
Oneirophanta mutabilis.
*Scotodeima parvispiculatum.
Scotodeima setigerum.
Laetmophasma fecundum.
Capheira sulcata
*Euphronides dysecrita.
Euphronides verrucosa.
Psychropotes raripes.
Benthodytes glutinosa.
*Benthodytes regularis.
Benthodytes sanguinolenta.
*Mesothuria megapoda.
Mesothuria multipes.
Synallactes aenigma.
*Synallactes triplax.
Pseudostichopus mollis.
Stichopus variegatus.
Holothuria arenicola.
Holothuria atra.
Holothuria cinerascens.
Holothuria imitans.
Holothuria impatiens.
Holothuria languens.
Holothuria lubrica.
Holothuria marenzelleri.
Actinopyga lecanora
Actinopyga parvula.

The 1904–1905 collection was always considered by Mr. Agassiz an exceptionally important one, an opinion based in part on the remarkably interesting trawl-hauls at several stations. Thus at station 4647, nine species were obtained, representing eight different genera, and two of the species are very notable new forms. At station 4649, five species of five genera were taken, one of the species being new. At 4651, seven species of seven genera, were secured and at 4656, five species of five genera. At 4658, eight species of seven genera, with two new species, were taken, and again at 4672, eight species of eight genera, with two new species, were brought in. It is not surprising therefore that Mr. Agassiz looked upon the collection as of great value. That it is not of more unusual importance, is owing to the facts that even the new forms nearly all belong to genera previously known from the eastern Pacific, while the Albatross 1891 expedition secured a large proportion of the species occurring in the deep waters of the region.

The new species described in the present report belong to the four families Synaptidae, Molpadiidae, Elpidiidae, and Holothuriidae, but the three new members of this last family are all members of the subfamily Synallactinae. The identification of deep-water holothurians, especially synallactids and elpidiids, is rendered difficult by the bad condition in which they reach the surface. It seems to be very exceptional for them to be taken in uninjured condition. More-

over the amount of their muscular contraction, and the particular form assumed, are subject to extraordinary diversity, as a result of which two very different specimens may prove to have the same essential structure and the same calcareous particles. In many cases the specimens are so distended with fine mud, it is hopeless to make anything out of the internal structure, and not infrequently the outer surface of the body-wall is so largely rubbed away, no pedicels are left and it is difficult to find any calcareous particles. In view of these conditions, calcareous particles prove exceptionally useful and faith in their genetic significance and taxonomic importance is greatly strengthened. It is very doubtful whether holothurians with essentially different spicules should be placed in the same genus and it is almost universally true that essential similarity in spicules indicates close relationship. At present our classification contains some very large and unnatural groups treated as genera (Cucumaria, Thyone, and Holothuria for example) which can probably be broken up into a number of small, natural genera by a proper valuation of their calcareous particles.

Of the new species described, all except the Benthodytes and the Euphronides, are particularly characterized by their spicules. The new Benthodytes is easily recognized, when well preserved by the body-form and arrangement of pedicels, and the Euphronides by the size and position of the dorsal appendage, but whether badly damaged or contracted specimens could be correctly identified is very doubtful. Of all the new forms, the two remarkable species of Myriotrochus are unquestionably the most interesting, as the genus has hitherto been considered characteristic of the subarctic zone. It is very perplexing to find the two closely allied species at one and the same station and nowhere else, for they are unquestionably quite distinct. The new Chiridota is interesting because it shows a well-marked spicule-character, unusual in this homogeneous genus. The same is true of the new Molpadia, since that is a genus in which the calcareous tables often lack any real distinctiveness.

The collections add little to our knowledge of the geographical distribution of holothurians, except in the notable extension of the range of Myriotrochus, to which reference has already been made. But it is of some interest to find *Chiridota rigida* as far southeast as Easter Island, *Benthodytes glutinosa* in the eastern Pacific and *Ceraplectana trachyderma* so far to the southward of the type-locality, the only place whence it was hitherto known.

The colored figures (Plates 1–3) were prepared by Mr. Agassiz and Mr. Westergren during the voyage of 1904–1905, but unfortunately the specimens from which they were made were not preserved separately or otherwise ade-

quately indicated, and hence in only a few cases has it been possible to determine from what specimen the colored figure was drawn. Each of the drawings, however, has the date and the number of the station at which the specimen was taken and it has therefore been possible in most cases by a process of elimination to find the probable originals. But doubts remain, and in two instances there seem to be no originals preserved. One of these figures having little that is distinctive is accordingly omitted from the published plates but the other is of such an unusual color (Plate 3, fig. 5), its publication seems desirable, especially since there is little doubt as to the genus.

SYSTEMATIC ACCOUNT.

SYNAPTIDAE.

Synapta maculata.

Holothuria maculata CHAMISSO & EYSENHARDT, 1821. De anim. Kotzebue obs., p. 352.
Synapta maculata JÄGER, 1833. De Holothuriis, p. 15.

This species was met with by the ALBATROSS twice on her earlier voyage. At Papeete, September 28, 1899, a good example of the typical form was secured and at Makemo, in the Paumotus, October 21 of the same year, two handsomely marked specimens of the variety *agassizii* (*S. agassizii* Selenka) were taken. These specimens are very conspicuously striped, five nearly white bands alternating with five more or less mottled brown ones of about the same width. Sufficient knowledge of this variety in life, and of the species as well, is as yet lacking, so that the true relation between them is unknown.

Protankyra abyssicola.

Synapta abyssicola THÉEL, 1886. CHALLENGER Hol., pt. 2, p. 14.
Protankyra abyssicola ÖSTERGREN, 1898. Öfv. K. Vet. Akad. Forh., **55**, no. 2, p. 117.

At two stations, this species was met with in 1904. Many of the specimens are of such size as to show that the species reaches a length of 150 mm. or more in life, with a corresponding diameter of at least 10 mm. In most of the specimens, the color is yellowish without red pigment but one is somewhat reddish. All have the full-sized anchors with distinct teeth on the arms, so that these specimens are certainly not *P. pacifica*. The appearance of the anchors, the developmental stages of which have perfectly smooth arms, leads one to question whether *pacifica* is really a valid form.

Station 4651. West of Peru, 5° 41′ 42″ S., 82° 59′ 42″ W., 2,222 fms. Bott. temp. 35.4°. Stky. fne. gy. s., trace of shore-mud.

Station 4666. Eastern Tropical Pacific, 11° 55′ 30″ S., 84° 20′ 18″ W., 2,600 fms. Bott. temp. 34.9°. Lt. gy. oz.

Sixteen specimens.

Chiridota aponocrita,[1] sp. nov.

Plate 4, fig. 1, 2.

Length in life, apparently about 75 mm.; the two fragments of the holotype measure in their preserved condition, 20 × 5 mm. and 15 × 4 mm. but these seem to constitute only about half the animal. Color (preserved), creamy white. The anterior piece bears twelve tentacles, each with seven digits on a side; tentacles 2–3 mm. long; terminal digits a full millimeter. Calcareous ring narrow, with no conspicuous projections on either margin; tentacle-bases relatively large, nearly concealing calcareous ring.

Calcareous particles numerous and characteristic. In tentacles, rods few, 40–60 μ long (Plate 4, fig. 1) very slightly branched at one or both ends, very little curved. Wheel-papillae numerous in all interambulacra anteriorly but few and scattered in ventral interambulacra at middle of body and perhaps posteriorly too; the absence of an indubitable posterior end prevents a positive decision. Wheels numerous in each papilla, and of diverse sizes, ranging from 55 to 110 μ in diameter. Body-wall everywhere, even in skin overlying wheel-papillae, crowded with minute curved rods or doughnut-shaped particles (Plate 4, fig. 2) only 12–20 μ long. No calcareous particles in longitudinal muscles.

Panama: Perico Island.

Three fragmentary specimens.

This Chiridota, although superficially not unlike several of the smaller members of the genus, is easily distinguished by the uniform coat of miliary particles in the outer layer of the body-wall. These are so numerous and small and have such a characteristic form, that *aponocrita* is one of the most easily recognized members of the genus. It is apparently a littoral species and no doubt occurs elsewhere at Panama, than at Perico Island.

Chiridota rigida.

Semper, 1868. Holothurien, p. 18.

There are two headless specimens in the 1904–1905 collection, measuring 25–30 mm. long by 4–5 mm. in diameter, which seem to be this species, though of course they are not certainly identifiable. They are of special interest because

[1] ἄπονος = without trouble + κρίτος = picked out, in reference to the ease with which it may be distinguished from allied forms.

they were taken on the shores of Easter Island, December 20, 1904. The wheels are only 45–65 μ in diameter and the curved rods, which are very sparsely scattered and not very variable, are but 27–36 μ in length. The small species of Chiridota need a careful revision based on the size, character, and distribution of the calcareous particles and when this is made the Easter Island form may be entitled to rank as a separate species, as the wheels seem to be much smaller than in typical *rigida*.

Myriotrochus bathybius,[1] sp. nov.

Plate 4, fig. 3.

Length of preserved specimen, 33 mm.; diameter, 8 mm. Oral disk, 8 mm. across, with scattered yellow-brown papillae, most numerous near mouth, each about one fourth of a millimeter high. Tentacles twelve, each with three minute digitations on each side. Color, gray; outside of circle of tentacles there are seven dark spots lying between tentacle-bases. Calcareous ring stout, with distinct projecting points on the anterior margin of both radial and interradial pieces; the posterior margins are, on the contrary, almost straight. Stone-canal single, short, compact, free. Polian vessel, single, long. Genital glands well developed on each side.

Calcareous particles consist of wheels alone, no deposits of any kind being found in the tentacles or oral disk. Wheels (Plate 4, fig. 3) very few and widely scattered; it may be that their scarcity is due to the abrasion of the epidermis during the long and rough journey to the surface in the trawl. Of the four seen, one had twelve, two had thirteen and one had fourteen spokes. Only two of these wheels were sufficiently uninjured to make the count of the teeth on the inner margin accurate; in a wheel with twelve spokes there were thirty-seven teeth and in one with thirteen spokes there were thirty-eight teeth. Evidently then the wheels in this species have typically thirteen spokes with the teeth three times as numerous. The most important feature of the wheels, however, is the hub which, as will be seen from the figure, is relatively large and has a circle of small oval perforations around the center. A few developmental stages of the wheels were found which explain this curious arrangement. As is the case with all wheels in the Synaptidae, the first beginning is a minute circular disk. Projections soon arise all around the margin and these lengthen into the spokes, which ultimately expand bilaterally at the tip, these expansions fusing with each other and forming the rim of the wheel. In the present species when the length

[1] $\beta\alpha\theta\acute{\upsilon}\beta\iota o\varsigma$ = deep-living, in reference to the great depth at which it occurs.

of the spokes is somewhat greater than the diameter of the original hub, a swelling appears near the middle of each spoke and as these swellings widen they come in contact and fuse with each other, leaving the circle of small oval holes, which apparently never fill up. The number of these holes thus corresponds to the number of spokes. The three wheels which were sufficiently complete to permit measurement were 240, 300 and 340 μ in diameter, with marginal teeth about.

Station 4647. Eastern Tropical Pacific, 4° 33′ S., 87° 42′ 30″ W., 2,005 fms. Bott. temp. 35.5°. Lt. gy. and br. glob. oz.

One specimen.

Although the superficial resemblance of this specimen is very close to that of the smaller of the two specimens of *M. giganteus*, the wheels are so different, it is impossible to consider it simply an aberrant example of the same species. The question of the relationships of *bathybius* is discussed under *giganteus*.

Myriotrochus giganteus,[1] sp. nov.

Plate 4, fig. 4.

Length 53 mm.; diameter 20 mm.; oral disk 12 mm. across. Form distinctly like Molpadia but for the lack of any caudal appendage. Smaller specimen, very much contracted and deformed, 35 mm. long, 9 mm. in diameter anteriorly but only 4 mm. at middle and posteriorly, and with oral disk 7 mm. across. Tentacles twelve, with 5–7 short but distinct digits on each side. Color, of smaller specimen gray; of holotype, light brown on a gray foundation, with area around anus and another area just back of and including tentacles on dorsal side, deep purple. Calcareous ring stout, with the radial pieces having rounded posterior, and broad blunt anterior, projections, and the interradial pieces similar except that the anterior projection is pointed. No stone-canal was found. Polian vessel single, small. Genital glands well developed on each side.

Calcareous particles are wheels alone, no deposits of any kind being found in the tentacles or oral disk. Wheels (Plate 4, fig. 4) fairly numerous but widely scattered; somewhat more numerous dorsally near the two ends of the animal than elsewhere, apparently, but this may be result of greater abrasion near middle of body. Of twenty-seven wheels observed sufficiently perfect to permit counting spokes, two had ten, nine had eleven, eight had twelve, seven had thirteen, and one had fourteen spokes, an average of not quite twelve spokes per wheel.

[1] γιγαντεῖος = like a giant, in reference to the exceptionally large size for a Myriotrochus.

Only twenty-three wheels were suitable for counting the marginal teeth and in these there is great diversity, the number ranging from twenty-one to thirty; the average number per wheel is a trifle more than twenty-four, or just about twice the number of spokes; the largest relative number is twenty-seven teeth for ten spokes and the smallest is twenty-two teeth for thirteen spokes. Hub of wheel small and solid, its diameter .20–.25 of wheel diameter. Wheels range from 190 to 315 μ across with the marginal teeth 30–50 μ long.

Station 4647. Eastern Tropical Pacific, 4° 33′ S., 87° 42′ 30″ W., 2,005 fms. Bott. temp. 35.5°. Lt. gy. and br. glob. oz.

Two specimens.

The occurrence of two species of Myriotrochus south of the equator and at a depth of over two thousand fathoms is one of the most extraordinary zoölogical discoveries made by the ALBATROSS during her 1904–1905 cruise. The genus has not hitherto been known south of Norway, Newfoundland, Alaska, and northern Japan, nor at a depth of more than a few hundred fathoms. The species taken at station 4647 are very different in general appearance from any of the known forms, but *giganteus* is much like the common subarctic species *rinkii* in the character of its wheels. The wheels of *giganteus* average a trifle larger than in *rinkii* but the difference is insignificant. The spokes, however, are noticeably fewer (10–14, average almost twelve, as against 12–22, average seventeen) and much wider, while the hubs are larger (.20–.25 wheel-diameter as against about .16). The marginal teeth are relatively more numerous in *giganteus*, where they average almost exactly double the number of spokes. The wheels in *bathybius* are conspicuously different from those of any other member of the genus. Both the tropical species seem to be much larger and stouter than *rinkii*, the largest of the previously known species, although there is not great difference in length, since Östergren reports specimens of *rinkii* up to 70 mm. long in life. The superficial resemblance of *giganteus* in form and color to a Molpadia is very striking and only the examination of the calcareous particles proves how misleading the resemblance is.

It was hard to convince myself that the holotype of *bathybius* was not merely an aberrant individual of *giganteus*, but the wheels are too markedly and consistently different to support such an idea. Moreover the differences in the digitation of the tentacles and in the calcareous ring cannot be ignored and no other conclusion seems possible than that these two closely-allied species live together on the ooze in the great depths of the eastern Pacific. It is an environment peculiarly suited to holothurians, as is well shown by the fact that nine different species were taken in the single haul of the trawl at station 4647.

Molpadiidae.

Molpadia bathybia,[1] sp. nov.

Plate 3, fig. 2; Plate 4, fig. 5, 6.

Length 50 mm., of which about 5 mm. is caudal appendage; diameter about 17 mm. Tentacles contracted out of sight and whole oral disk more or less shrunken. Body-wall, very thin. Color, gray. No phosphatic deposits. Calcareous particles, tables only but these very abundant though not crowded. Tables not perfectly symmetrical but not notably asymmetrical, and the disks never have projecting rods, nor do they tend to narrow down in the posterior end into supporting rods; disks (Plate 4, fig. 5) 200–300 μ across with three primary holes, three secondary holes, often nearly as big, and not uncommonly additional marginal holes, so that there may be twenty or even more perforations; spire (Plate 4, fig. 6) made up at base of three rods which quickly fuse into a smooth straight rod with blunt tip, 200–250 μ high.

Station 4670. Peru: west of Palominos Light House, 105 miles. 3,209 fms. Bott. temp. 35.4°. Fne. dk. br. m.
Station 4672. Peru: southwest of Palominos Light House, 88 miles. 2,845 fms. Bott. temp. 35.2°. Fne. dk. br. infus. m.

Two specimens.

The holotype is from station 4672. The other specimen (Plate 3, fig. 2) is slightly smaller but has the same proportions, with the tentacles somewhat less contracted and apparently fifteen in number. There are no phosphatic bodies and the calcareous particles are as in the holotype. This species is nearly allied to *M. arctica* but the tables are markedly different. In the absence of phosphatic bodies and supporting rods and the total lack of anchors and plates, *bathybia* is easily distinguished from all the species hitherto known from the eastern tropical Pacific.

Molpadia holothurioides.

Plate 3, fig. 1.

Cuvier, 1817. Reg. Anim., 4, p. 24.
Molpadia musculus Risso, 1826. Hist. Nat. Europe, 5, p. 293.

In Apodous Holothurians (Washington, 1908[2]), I accepted *holothurioides* as the type of the genus Molpadia but did not accept it as a valid specific name within the genus, placing it instead as a questionable synonym under *M. mus-*

[1] $\beta\alpha\theta\acute{\upsilon}\beta\iota o\varsigma$ = deep-living, in reference to the unusual depth of its habitat.
[2] Although dated 1907, this book was not issued until January, 1908.

culus. Such a course now seems illogical and the acceptance of Cuvier's specific name is the most satisfactory solution of the difficulty. There is little doubt that Cuvier and Risso were dealing with the same species and since Ludwig has clearly shown what the species is, described as *musculus* by Risso, that species ought to bear Cuvier's name.

The species has a wide distribution and probably the name in its present sense really covers several valid species, but the specimens in the present collection throw no light on the matter. They range from 30 to 115 mm. in length. The smallest have very insignificant caudal appendages, relatively few phosphatic bodies, and many anchors; several are evidently *Ankyroderma spinosum* Ludwig. The largest specimens are quite red from the crowded phosphatic deposits, and their caudal appendages are relatively long.

The two colored figures given, obviously do not represent a single species. There is little reason to doubt that Plate 3, fig. 1 represents an adult *holothurioides*, though the color is more roseate than would be expected and the absence of a caudal appendage is notable. But Plate 3, fig. 5, while almost certainly a Molpadia can hardly be *holothurioides*. The figure is published in order to record the occurrence in the Eastern Pacific of a holothurian, having this most unusual green color. The drawing is based on a specimen recorded from station 4630, but there is no molpadiid in the collection now from that station; at 4631, however, *M. holothurioides* was taken.

Station 4631. Panama: off Mariato Point, 72 miles. 774 fms. Bott. temp. 38°. Gn. s.
Station 4651. Peru: west of Aguja Point, 111 miles. 2,222 fms. Bott. temp. 35.4°. Fne. stky. gy. m.
Station 4672. Peru: southwest of Palominos Light House, 88 miles. 2,845 fms. Bott. temp. 35.2°. Fne. dk. br. infus. m.

Twenty specimens.

Ceraplectana trachyderma.

H. L. Clark, 1908. Apod. Hol., p. 39.

The rediscovery, off the coast of Peru, in very deep water, of this remarkable holothurian hitherto known only from the type-locality in the vicinity of the Aleutian Islands, is one of the interesting results of the 1904–1905 expedition. The specimens are in very good condition, except that one has all but one of the curious horny tentacles missing; apparently they have been torn off. The larger specimen is 52 mm. long and 17 mm. in diameter, with a caudal appendage about 9 mm. in length. The smaller specimen is about four fifths as large. The color is gray finely speckled with brownish red, but the oral disk

is nearly white with the tentacles bright brown in sharp contrast. In no important particular do these specimens differ from those originally described.

Station 4672. Peru: southwest of Palominos Light House, 88 miles. 2,845 fms. Bott. temp. 35.2°. Fne. dk. br. infus. m.

Two specimens.

Cucumariidae.

Cucumaria abyssorum.

Plate 2, fig. 5.

Théel, 1886. Challenger Hol., pt. 2, p. 66.

The specimens range from 50 to 75 mm. in length and call for little comment. Examination of the body-wall seems to indicate that the calcareous particles decrease in number with age. At any rate, the largest specimens lack spicules more or less completely.

Station 4647. Eastern Tropical Pacific, 4° 33′ S., 87° 42′ 30″ W., 2,005 fms. Bott. temp. 35.5°. Lt. gy. and br. glob. oz.
Station 4649. Eastern Tropical Pacific, 5° 17′ S., 85° 19′ 30″ W., 2,235 fms. Bott. temp. 35.4°. Fne. stky. gn. m.
Station 4651. Peru: west of Aguja Point, 111 miles. 2,222 fms. Bott. temp. 35.4°. Fne. stky. gy. m.
Station 4656. Eastern Tropical Pacific, 6° 54′ 36″ S., 83° 34′ 18″ W., 2,222 fms. Bott. temp. 35.2°. Fne. gn. m., mang. nod.

Thirteen specimens.

Pseudocucumis africana.

Cucumaria africana Semper, 1868. Holothurien, p. 53.
Pseudocucumis africana Ludwig, 1888. Zool. Jahrb. Syst., **3**, p. 815.

On February 8, 1900, six specimens of this very well-marked species were taken at Kusaie in the Caroline Islands, on a reef. This seems to be the most easterly record for the species, which is now known from Japan on the north to Torres Strait on the south and from Portuguese East Africa eastward to Kusaie.

Echinocucumis bitentaculata.

Sphaerothuria bitentaculata Ludwig, 1893. Bull. M. C. Z., **24**, p. 112.

It is difficult to believe that there is any generic distinction between *Echinocucumis typica* Sars and Ludwig's *Sphaerothuria bitentaculata*. In the contracted condition in which they are ordinarily taken, it is very difficult, if not impossible, to determine the number and relative sizes of the tentacles, and it is doubtful whether the supposed differences are real and constant. R. Perrier considers Ludwig's genus a synonym of E. Perrier's Ypsilothuria and of this

there can be little doubt, but I believe Perrier's genus synonymous with Sars's. Whether there is more than one species in the genus is not yet satisfactorily determined for the diversity of form even in specimens from the same spot is very great, and it is yet to be shown how much of this is natural and how much is artificial, *i. e.* the result of contraction during preservation. The specimen in the present collection is 13 mm. long and 10 mm. high; the anal tube is 2–3 mm. long but the oral end is strongly contracted and no tentacles are visible.

Station 4631. Panama: off Mariato Point, 72 miles. 774 fms. Bott. temp. 38°. Gn. s.

One specimen.

PELAGOTHURIIDAE.

Pelagothuria natatrix.

LUDWIG, 1893. Bull. M. C. Z., **24**, p. 111.

This remarkable pelagic holothurian must be quite common in the eastern tropical Pacific for it is well represented in both of the ALBATROSS collections. But all of the specimens are in poor condition and offer nothing additional to Ludwig's very full description. They are all of about the same size, apparently adult. The following list of stations is interesting as throwing much light on the distribution.

Station 16.[1] Eastern Tropical Pacific (660 miles northeast of the Marquesas), 2° 38′ N., 137° 22′ W. 2,440 fms.
Station 17. Eastern Tropical Pacific, 0° 50′ N., 137° 54′ W., 2,463 fms.
Station 4641. Galapagos: Hood Island, 12 miles southeast of Ripple Point, 633 fms.
Station 4645. Galapagos: south of Chatham Island, 1,955 fms.
Station 4646. Eastern Tropical Pacific, 4° 1′ 36″ S., 89° 16′ 18″ W., 2,058 fms.
Station 4715. Galapagos: southwest of Hood Island; tow at 300 fms.
Station 4716. Galapagos: 55 miles southwest of Hood Island; surface tow.
Station 4717. Eastern Tropical Pacific, 5° 10′ S., 98° 56′ W.; tow at 300 fms.
Station 4721. Eastern Tropical Pacific, 8° 7′ 30″ S., 104° 10′ 30″ W.; tow at 300 fms. and up to surface.
Station 4742. Eastern Tropical Pacific, 0° 3′ 24″ N., 117° 15′ 48″ W.; tow at 300 fms.

Thirty-three specimens.

ELPIDIIDAE.

Parelpidia anamesa,[2] sp. nov.

Plate **3**, fig. 3.

Length 85 mm.; diameter, 15 mm. Color, light yellow-brown. Body-wall very thin and soft. Tentacles ten. The specimen is in such poor condition and so filled with mud, none of the details of the internal organization could

[1] Bottom temperature and character of bottom omitted, since the species is pelagic.

[2] ἀνάμεσος = intermediate, in reference to the fact that the species seems to connect Parelpidia and Peniagone.

be made out; not even a calcareous ring was detected. Posterior end of body, flattened. Pedicels present around posterior end, but their number, size, and relative positions could not be determined. Calcareous particles characteristic; in skin of dorsal surface are quadriradiate spicules, each of the four, only very slightly thorny branches curved inward rather strongly, while from their common center arises an outwardly directed nearly smooth spine; the curved rods are 350–550 μ long and the projecting spine 300–400 μ; in the ventral skin, the spicules are smaller with less curved rods and two to four low, rough, projecting spines or knobs, much as in *Peniagone intermedia*.

Station 4658. Eastern Tropical Pacific, 8° 30′ S., 85° 35′ 36″ W., 2,370 fms. Bott. temp. 35.3°. Fne. gn. m., mang. nod.

One specimen.

It is by no means sure that this species is properly referred to Parelpidia rather than to Peniagone but the elongated form and the apparent absence of any dorsal appendage seem to justify the position given. The spicules of the dorsal surface are the really characteristic feature and will serve to distinguish even more badly preserved specimens than the holotype (Plate 3, fig. 3). Judging from the colored drawing, made from life, there are only three pedicels on each side of the body and these are widely separated. There seem to be none around the flattened posterior end.

Scotoplanes murrayi.

Plate 3, fig. 6.

Elpidia murrayi Théel, 1879. Bih. K. Sven. Vet. Akad. Handl., 5, no. 19, p. 16.
Scotoplanes murrayi Théel, 1881. Challenger, Hol., pt. 1, p. 34.

The Albatross specimens are all much larger than the holotype of *murrayi*, ranging from 55 to 85 mm., but there seems no good reason for considering them specifically distinct. The calcareous particles are actually larger than in Théel's specimen but relatively they are about the same. The rods are 1–1.25 mm. long and correspondingly stout; they are abundant; the C-shaped bodies are also very plentiful and relatively large. The skin is very thin and owing to the abundance of the spicules is quite brittle. The left-hand papilla in one specimen (Station 4672) is double. In the same specimen, there are only *five* papillae in one lateral series, though there are *six* in the other. This specimen is further remarkable for having contained a parasitic worm, apparently an Ichthyonema.

Station 4651. Peru: west of Aguja Point, 111 miles. 2,222 fms. Bott. temp. 35.4°. Fne. stky. gy. m.
Station 4672. Peru: southwest of Palominos Light House, 88 miles. 2,845 fms. Bott. temp. 35.2° Fne. dk. br. infus. m.

Four specimens.

Periamma tetramerum,[1] sp. nov.

Plate 2, fig. 4.

Length, 50 mm.; diameter, 15 mm. Body-wall very thin and delicate. Color, pale yellowish brown and grayish; the gray areas appear to be where the brown is rubbed off. Tentacles ten. Pedicels, eight on each side, the most anterior largest (2 mm. long or more), situated anterior to middle of body; the posterior four smallest and more or less united together. About 12 mm. back of anterior end is a transverse crest, 8–9 mm. wide and 4 mm. high, more or less lobed, but not markedly so; this crest is apparently made up by the fusion of two pairs of processes, *i. e.* four projecting papillae, and back of it, there is on each side a similar papilla 1.5 mm. high. General appearance much like a small *Scotoplanes robusta.* Internal anatomy completely indeterminable owing to the whole interior being densely packed with mud.

Calcareous particles very characteristic. In deeper layer of skin are numerous C-shaped (sometimes S-shaped) bodies, 100 μ long. External to these is a layer of very diversified thorny spicules, generally *tetramerous;* each forms a more or less perfect cross with two opposite arms shorter than the other two; rarely the spicules are trimerous or pentamerous; each arm of a spicule is usually about 100 μ long but often they are less. Here and there among these crosses are much stouter, thorny rods, 200–300 μ long; these often have a short branch, at a right angle, on one side, near the middle.

Station 4670. Peru: west of Palominos Light House, 105 miles; 3,209 fms. Bott. temp. 35.4°. Fne. dk. br. m.

Six specimens.

These specimens seem to have suffered considerable damage in the ascent of the trawl, for in the largest ones the outer spicule layer is nearly all rubbed off leaving only the C-shaped particles. The dorsal crest is more or less damaged but its form and size are fairly recognizable. The number, size, and arrangement of the pedicels is also distinguishable in most of the specimens. The spicules are very characteristic and there will be no difficulty in recognizing examples of the species where enough of the epidermis is intact to permit the existence of the crosses to be determined.

[1] τετράμερος = having four parts, in referenee to the characteristie spieules.

Peniagone bispiculata,[1] sp. nov.

Length about 45 mm.; width, back of middle, about 30 mm. Body oval, narrower in front, very flat in the preserved specimens but probably less so in life. Tentacles ten, relatively large. Oral surface with 10–12 very large pedicels surrounding it, beginning near mouth on each side; even in their contracted condition these pedicels are several millimeters long and 2 mm. thick at base. Dorsal crest thin, rather low, rounded, about 10 mm. wide by 5 mm. high, placed close to anterior end of body. On right side, 12 mm. back of crest, is a papilla 6 mm. long by 2 mm. thick, pressed down flat against body; no corresponding papilla can be detected on the left side but it may have been broken off, and as the whole body-surface is very much wrinkled and folded, its point of attachment is no longer to be found. Color, gray (holotype) or pinkish (paratypes).

Calcareous particles not very distinctive except by size; they resemble those of *P. intermedia* but are more slender and have more pointed tips to the four inwardly curved arms; these arms are 100–120 μ long; here and there among these small and very numerous spicules are scattered abruptly larger ones with arms 150–170 μ long.

Station 17. Eastern Tropical Pacific, 0° 50′ N., 137° 54′ W., 2,463 fms. Bott. temp.? Lt. yel.-gy. glob. oz.

Three specimens.

While this new Peniagone resembles *vitrea* and *intermedia* in certain particulars, the arrangement of the large pedicels and the form of the body are very different from what is found in either of those species. The size of the spicules and particularly the existence of two very different sizes are also distinctive points. It is at least worthy of note that while the holotype is fairly well preserved the paratypes are in very bad condition, each of them being split open down the back for the entire length. The appearance suggests that with the release from the bottom-pressure these specimens exploded leaving only the empty skin, which had proved weakest along the middorsal line.

Peniagone intermedia.

Ludwig, 1893. Bull. M. C. Z., **24**, p. 109.

The specimens referred to this species are in such poor condition, that their identification is far from certain. They are supposed to belong to *inter-*

[1] *bispiculata* = having two kinds of spicules, in reference to the two distinct sizes in the calcareous particles.

media because of a fairly close similarity in calcareous particles but whether the dorsal appendage and the pedicels are also similar, it is out of the question to determine. They certainly add nothing to our knowledge of the species.

Station 4647. Eastern Tropical Pacific, 4° 33′ S., 87° 42′ 30″ W., 2,005 fms. Bott. temp. 35.5°. Lt. gy. and br. glob. oz.

Station 4658. Eastern Tropical Pacific, 8° 30′ S., 85° 35′ 36″ W., 2,370 fms. Bott. temp. 35.3°. Fne. gn. m., mang. nod.

Station 4672. Peru: southwest of Palominos Light House, 88 miles. 2,845 fms. Bott. temp. 35.2°. Fne. dk. br. infns. m.

Ten specimens.

Peniagone setosa.

Peniagone vitrea var. *setosa* Ludwig, 1893. Bull. M. C. Z. **24**, p. 109.

Comparison of the present specimen with a cotype of Ludwig's variety has satisfied me that the two are identical and that both are perfectly distinct from *vitrea* Théel. I therefore raise the variety to full specific rank. It is easily recognized by the abundance and large size of the spicules, the curved arms of which are 300–530 μ in length, with the outwardly directed spines, 300–470 μ. The Albatross specimen is lighter and less gray than the cotype and the crest is much less evident. The length is rather more than 50 mm.

Station 4658. Eastern Tropical Pacific, 8° 30′ S., 85° 35′ 36″ W., 2,370 fms. Bott. temp. 35.3°. Fne. gn. m., mang. nod.

One specimen.

Peniagone vitrea.

Théel, 1881. Challenger Hol., pt. 1, p. 50.

Although the specimen at hand is badly rubbed and lacks its tentacles, and although the integument is not at all glassy or "hard, brittle and rough," I feel little doubt about the identity, for the shape of the body, the arrangement of the pedicels and the calcareous particles agree well with Théel's description. The color is yellowish white and the body-wall is quite opaque. The body posterior to crest is 50 mm. long, anterior to crest is 30 mm. and its width is 25 mm. The crest is 25 mm. high and while its margin is irregular there are no definite four projections visible. There is a note with the specimen indicating that the color in life was "pink."

Station 17. Eastern Tropical Pacific, 0° 50′ N., 137° 54′ W., 2,463 fms. Bott. temp.? Lt. yel.-gy. glob. oz.

Deimatidae.

Oneirophanta mutabilis.

Théel, 1879. Bih. K. Sven. Vet. Akad. Handl., **5**, no. 19, p. 6.

The present series confirms Théel's statements concerning the diversity shown by this species. I doubt very much the validity of the species which

have been proposed in Oneirophanta during the period since the CHALLENGER Report was published. They seem to me to come well within the range of diversity shown by *mutabilis*. If all are valid, the specimen in the present collection from Station 4732 may well be made the type of a new species. It is about 80 mm. long and the pedicels and processes are so few and small they might easily be overlooked; the body-wall is like thin glass and the body is full of fine light-colored sand. The other specimens range from 45 to 200 mm. in length and are for the most part glassy and nearly white but one of the largest specimens is quite brown. The extent of digitation shown by the tentacles and the number of midventral pedicels are characters of very great diversity. The number and size of the lateral pedicels also show a great range as Théel pointed out; in one specimen 150 mm. long, the pedicels are 20 mm. long by 6 mm. in diameter while the marginal papillae are 45 mm. long and 8 mm. thick at the base. The calcareous plates are very characteristic and while they show considerable diversity, the specific features are not obscured.

Station 4647. Eastern Tropical Pacific, 4° 33′ S., 87° 42′ 30″ W., 2,005 fms. Bott. temp. 35.5°. Lt. gy. and br. glob. oz.
Station 4649. Eastern Tropical Pacific, 5° 17′ S., 85° 19′ 30″ W., 2,235 fms. Bott. temp. 35.4°. Fne. stky. gr. m.
Station 4651. West of Peru, 5° 41′ 42″ S., 82° 59′ 42″ W., 2,222 fms. Bott. temp. 35.4°. Stky. fne. gy. s., trace of shore-mud.
Station 4656. Eastern Tropical Pacific, 6° 54′ 36″ S., 83° 34′ 18″ W., 2,222 fms. Bott. temp. 35.2°. Fne. gn. m., mang. nod.
Station 4658. Eastern Tropical Pacific, 8° 30′ S., 85° 36′ W., 2,370 fms. Bott. temp. 35.3°. Fne. gn.m., mang. nod.
Station 4732. Eastern Tropical Pacific, 16° 32′ 30″ S., 119° 59′ W., 2,012 fms. Bott. temp. 34.8°. Lt. gy. glob. oz.

Sixteen specimens.

Scotodeima parvispiculatum,[1] sp. nov.

Plate 4, fig. 7, 8.

Length, 60 mm.; breadth, 12 mm. Color, dirty white. Body very flat, in bad condition, more or less eviscerated. Tentacles wanting. Dorsally there are six rows of conical papillae, of which two series are along each margin; all the papillae look rubbed but they probably never had very long tips. Arrangement of pedicels on ventral surface not distinguishable but there were probably none in midventral ambulacrum at least anteriorly. Marginal papillae smaller and forming a marginal fringe anteriorly. Mouth ventral. Anus dorsal.

Calcareous particles remarkably small and quite characteristic. They

[1] *parvispiculatus* = provided with little spicules, in reference to the small size of the calcareous particles.

usually have 4 rays or arms (Plate 4, fig. 7) but often there are 5 or more (Plate 4, fig. 8); the arms are flat, perforated with several holes at their enlarged tips, and occasionally have little spines on the sides. The whole spicule is rarely 200 μ long, while somewhat similar spicules in *S. protectum* are about 700 μ long.

Station 4658. Eastern Tropical Pacific, 8° 30′ S., 85° 36′ W., 2,370 fms. Bott. temp. 35.3°. Fne. gn. m., mang. nod.

One specimen.

This species is readily distinguished from other known species of the genus by the very small and characteristic spicules. It is unfortunate that the condition of the specimen does not permit a better knowledge of its external features and internal anatomy.

Scotodeima setigerum.

Ludwig, 1893. Bull. M. C. Z., **24**, p. 109.

Although these specimens are in fairly good condition, they contribute nothing of importance to Ludwig's full account (1894, Mem. M. C. Z., **17**, p. 74–79). They range in length from 55 to 88 mm.

Station 4647. Eastern Tropical Pacific, 4° 33′ S., 87° 42′ 30″ W., 2,005 fms. Bott. temp. 35.5°. Lt. gy. and br. glob. oz.

Station 4649. Eastern Tropical Pacific, 5° 17′ S., 85° 19′ 30″ W., 2,235 fms. Bott. temp. 35.4°. Fne. stky. gr. m.

Seventeen specimens.

Laetmophasma fecundum.

Ludwig, 1893. Bull. M. C. Z., **24**, p. 109.

The specimen, about 50 mm. long, is in such wretched condition that there is little certainty about the identification. But there is no doubt that some at least, of the now more or less decalcified, deposits were wheels like those of *L. fecundum* and there is nothing improbable about the specimen representing that species.

Station 4653. West of Peru, about 17 miles, 5° 47′ S., 81° 24′ W., 536 fms. Bott. temp. 41.3°. Dk. br. gy. shore m.

One specimen.

Capheira sulcata.

Ludwig, 1893. Bull. M. C. Z., **24**, p. 109.

The representatives of this species are in very bad condition indeed but the calcareous particles agree well with Ludwig's description and figures (1894,

Mem. M. C. Z. 17, p. 100, plate 6, fig. 1–5). In one specimen it is possible to find the tentacles and there seem to be only *sixteen*.

Station 4647. Eastern Tropical Pacific, 4° 33′ S., 87° 42′ 30″ W., 2,005 fms. Bott. temp. 35.5°. Lt. gy. and br. glob. oz.
Station 4658. Eastern Tropical Pacific, 8° 30′ S., 85° 35′ 36″ W., 2,370 fms. Bott. temp. 35.3°. Fne. gn. m., mang. nod.

Two specimens.

Psychropotidae.

Euphronides dyscrita,[1] sp. nov.

Plate 2, fig. 3.

Length, 75 mm.; width, 17 mm. or more. Dorsal appendage, 18 mm. long, 10 mm. wide at base, 5 mm. wide at tip; situated only 8 mm. from posterior end of body; somewhat flattened and with tip rounded. Mouth and anus, ventral. Tentacles apparently 18, but the number is hard to make out. Color, yellow-brown above; deep purple below; tentacles, very deep purple. There is a well-marked and frequently lobed margin but it is in too poor condition to permit its exact character to be determined.

Calcareous particles strongly arcuate 4-armed bodies with thorns but no conspicuous spines either at center or elsewhere; arms 125 μ long or longer and occasionally twice that, but the large ones are very slender. Though very abundant dorsally, the spicules are not crowded there; if present ventrally they are more scattered and are concealed by the heavy pigmentation.

Station 4672. Peru: southwest of Palominos Light House, 88 miles. 2,845 fms. Bott. temp. 35.2°. Fne. dk. br. infus. m.

Two specimens.

The holotype is in poor condition but the paratype is much worse and gives no assistance as to the generic and specific characters. It is light gray above with a brownish tinge but most of the external layer of skin is rubbed off. It shows the well-marked, lobed margin but lacks the dorsal appendage or at best, possesses but a fragment. The species looks like a short-tailed Psychropotes but the appendage is so short and the calcareous particles are so strongly arcuate, it seems better placed in Euphronides. The position of the dorsal appendage, and the calcareous particles serve to distinguish it from any other member of the genus.

[1] δύσκριτος = hard to determine, in reference to the doubtful generic position.

Euphronides verrucosa.

Plate 1, fig. 2.

Ludwig, 1893. Bull. M. C. Z. **24**, p. 107.

The representative, from station 4742, of this fine species is in fairly good condition and is a very large one, nearly 200 mm. long by 50 mm. wide. The colors in life are shown on Plate 1, but in the preserved specimen, the lower surface is very dark purple while the upper side is light, dull rose-purple. There are only sixteen tentacles. The characteristic calcareous spicules of the dorsal side are very conspicuous.

The specimen from station 17 is labeled by Mitsukuri "Euphronides bifurcata K. & V." and is accompanied by the following note:—

"Specimen very much contracted and distorted. 16 tentacles. A little behind the posterior, and one-third of the total length on the dorsal surface, 1 pair of not very long nor very large appendages, 1.1 cm. long. 2 more pairs of much smaller appendages in front. At the dorso-ventral border, irregular lobed brim. Body not very flat. Posterior part dorsal high. Ventral surface sole-like, flat. A row of paired pedicels on the median ventral ambulacrum. On the dorsal, a number of warts, each supported by one four-branched spicule, from which the central needle projects."

I have examined the specimen with great care but fail to find any dorsal appendages nor can I distinguish the specimen in any adequate way from that from station 4742 which I have referred to *verrucosa*. Whether Mitsukuri made a mistake, or whether the mistake is mine, or whether *bifurcata* K. & V. is identical with *verrucosa* Ludwig, more material alone can determine.

Station 17. Eastern Tropical Pacific, 0° 50′ N., 137° 54′ W., 2,463 fms. Bott. temp.? Lt. yel.-gy. glob. oz.

Station 4742. Eastern Tropical Pacific, 0′ 3′ 24″ N., 117° 15′ 48″ W., 2,320 fms. Bott. temp. 34.3°. Fne. lt. gy. glob. oz.

Two specimens.

Psychropotes raripes.

Plate 1, fig. 1.

Ludwig, 1893. Bull. M. C. Z., **24**, p. 107.

The two representatives of this species are very big adults and are much the largest deep-water holothurians in the collection. The specimen from 4658 is in remarkably perfect condition; the body is 170 mm. long, with the tail 110 mm. in addition; the maximum width for the body, as well as for the tail, which has convex lateral margins, is 45 mm. The tail is very flat and distinctly notched at tip. The general color is gray above becoming purple below, with the lower surface of the tail reddish; tentacles purple. The specimen from 4721 (Plate 1, fig. 1) is not in as fine condition but is still

larger; the body, 220 mm., the tail 180 mm., and the width 50 mm. Mr. Agassiz states that in life this specimen was 55 cm. long. The tip of the tail is less distinctly notched than in the other specimen. The color is violet much faded dorsally, where it is almost gray; the tentacles are brown.

Station 4658. Eastern Tropical Pacific, 8° 30′ S., 85° 36′ W., 2,370 fms. Bott. temp. 35.3°. Fne. gn. m., mang. nod.
Station 4721. Eastern Tropical Pacific, 8° 7′ 30″ S., 104° 10′ 30″ W., 2,084 fms. Bott. temp.? Lt. br. glob. oz.

Two specimens.

Benthodytes glutinosa.

Plate **2**, fig. 1.

R. Perrier, 1896. Compt. Rend., **123**, p. 903.

This species, originally described from the Atlantic, has since been recorded from the Indian Ocean by Koehler and Vaney. The present specimen appears to agree with these latter in the entire absence of spicules. Otherwise the agreement with Perrier's later, fuller description and figures (1902, Travailleur et Talisman Hol., p. 462; plate 13, fig. 5 and plate 20, fig. 31) is very close. The differences between *glutinosa* and *typica* do not seem to be very weighty and it is probable that the two are identical.

Station 4647. Eastern Tropical Pacific, 4° 33′ S., 87° 42′ 30″ W., 2,005 fms. Bott. temp. 35.5°. Lt. gy. and br. glob. oz.

One specimen.

Benthodytes regularis,[1] sp. nov.

Plate **2**, fig. 2.

Length, 105 mm.; thickness about 15 mm., but when both margins are spread flat, the width is 22 mm. Seen from below the appearance is much like Théel's figure of *B. sanguinolenta* var. *marginata* (1886, Challenger Hol., plate 25, fig. 2) but the upper surface is very different from that of *marginata*. On each dorsal ambulacrum is a series of fourteen or fifteen papillae in a single row; these begin 25 mm. back of anterior end of body, are of nearly uniform size and quite evenly spaced; each is about 2–2.5 mm. high by 1.5 mm. in basal diameter; the form is bluntly conical. Mouth ventral but anus dorsal. Anterior end quite flattened. Midventral line of pedicels distinct but they are small and fully retracted; they are wanting on the anterior region for a distance of 20 mm. or more. Tentacles not permitting an accurate count,

[1] *regularis* = according to rule, in reference to the regular arrangement of the dorsal papillae.

probably fifteen but perhaps only twelve. Color, dull purplish gray; tentacles, margin (at least orally) and midventral series of pedicels, deep purple.

Calcareous particles apparently wanting ventrally but scatteringly present dorsally; they have the form of crosses with nearly equal, slender, thorny arms; each cross is about 125 μ across but here and there were fragments of larger crosses at least 250 μ across. The outer layer of skin is badly rubbed off and as the crosses are in this layer, it is probable the fragmentary condition of the larger crosses is due to rough treatment in the trawl. Perhaps the absence of spicules ventrally is due to the same cause.

Station 4649. Eastern Tropical Pacific, 5° 17′ S., 85° 19′ 30″ W., 2,235 fms. Bott. temp. 35.4°. Fne. stky. gr. m.

One specimen.

This species appears to be well characterized by the regular arrangement of the conspicuous dorsal papillae but the species of Benthodytes are most perplexing, particularly as they usually lack spicules or possess only such as are not very distinctive. Specific limits within the genus, as at present drawn, must be considered purely tentative.

Benthodytes sanguinolenta.

Théel, 1881. Challenger Hol., pt. 1, p. 104.

This species is a convenient catch-all for specimens which are more or less elongated, have no calcareous particles, and lack any other distinctive feature. Whether more than a single species has been, or is here, listed under the name, it is impossible to say, owing to the almost uniformly bad condition of the material. The specimens from the following stations are from 50–80 mm. long and hence probably young, excepting one in fairly good condition, which is 140 mm. long by 15 mm. thick. The specimen from 4740 appears to have only thirteen tentacles.

Station 4651. Peru: west of Aguja Point, 111 miles. 2,222 fms. Bott. temp. 35.4°. Fne. stky. gy. m.
Station 4658. Eastern Tropical Pacific, 8° 30′ S., 85° 36′ W., 2,370 fms. Bott. temp. 35.3°. Fne. gn. m. mang. nod.
Station 4672. Peru: southwest of Palominos Light House, 88 miles. 2,845 fms. Bott. temp. 35.2°. Fne. dk. br. infus. m.
Station 4732. Eastern Tropical Pacific, 16° 32′ 30″ S., 119° 59′ W., 2,012 fms. Bott. temp. 34.8°. Lt. gy. glob. oz.
Station 4740. Eastern Tropical Pacific, 9° 2′ S., 123° 20′ W., 2,422 fms. Bott. temp. 34.2°. Dk. gy. glob. and rad. oz.

Eleven specimens.

Holothuriidae.

Mesothuria megapoda,[1] sp. nov.

Plate 4, fig. 9, 10.

Length about 40 mm. Color, pinkish white. Eviscerated and in bad condition so even the generic position is not certain, but the calcareous tables show such similarity to those of *M. murrayi* and *M. multipes* that there is little doubt the specimen represents a species of Mesothuria. Body rather uniformly covered with large pedicels, 2–3 mm. long and .50–.75 mm. in diameter; there is no arrangement in series or bands, nor are any of the pedicels conspicuously larger than the others. There are no supporting rods in the pedicels but there are well-developed terminal plates.

Calcareous particles consist of very numerous tables (Plate 4, fig. 9) with spires 100–135 μ high; the three rods making up the spire are enlarged, curved outwards and rough at the tip. The disks (Plate 4, fig. 10) are 150–200 μ across and are perforated with seven nearly equal holes, one at center with six around it; while they are not all exactly alike, they exhibit little diversity.

Station 4742. Eastern Tropical Pacific, 0° 3′ 24″ N., 117° 15′ 48″ W., 2,320 fms. Bott. temp. 34.3°. Fne. lt. gy. glob. oz.

One specimen.

Although the specimen is in such poor condition its specific characters are well marked. It is distinguished at once from *M. multipes* by the larger pedicels, the presence of a well-developed terminal plate and the larger, lower tables. In *multipes*, the disks of the tables are only 75–100 μ across, while the spires are much more than that. From *M. murrayi*, *megapoda* may be readily distinguished by the uniform and large size of the pedicels and by the difference in the tables. In *murrayi*, the disks are only 70–120 μ across but have more numerous perforations.

Mesothuria multipes.

Mesites multipes Ludwig, 1893. Bull. M. C. Z., **24**, p. 106.
Mesothuria multipes Ludwig, 1894. Mem. M. C. Z., **17**, p. 31.

The specimen at hand has eviscerated so nothing can be said of its internal anatomy. Otherwise it agrees well with Ludwig's description except that the tentacles are very dark colored, deep purplish. It is 60 mm. long.

[1] μεγάποδος = having large feet, in reference to the unusually large pedicels.

Station 4656. Eastern Tropical Pacific, 6° 54′ 36″ S., 83° 34′ 18″ W., 2,222 fms. Bott. temp. 35.2°. Fne. gn. m., mang. nod.

One specimen.

Mesothuria multipora,[1] sp. nov.

Plate 4, fig. 11–13.

Length, 140 mm.; diameter, about 50 mm. Color, gray. Internal anatomical details not definable as the specimen has eviscerated. Pedicels scattered all over body, but most sparsely dorsally; dorsal pedicels about 1 mm. long by .25 mm. in diameter; the pedicels are much more numerous and twice as large along the sides. Skin in close, horizontal, nearly black folds along each side, forming a fairly distinct border between dorsal and ventral surfaces.

Calcareous particles present in the form of tables (Plate 4, fig. 11) alone. These are all of the same type and show diversity chiefly in the number of perforations in the disk; spire with one cross-beam, about 75 μ high and 50 μ across the top (Plate 4, fig. 13) which bears about sixteen teeth; disk (Plate 4, fig. 12) squarish, 200 μ across, with a somewhat square central hole and thirty to fifty more or less circular perforations of small size.

Station 74. Tahiti: 4.8 miles N., 82° W. from Point Venus, 772 (?) fms. Bottom temp.? Fne. vol. s. (?).

One specimen.

This specimen was labeled by Professor Mitsukuri "*Mesothuria intestinalis* Asc. Rathke (*Hol. Verrillii* Théel)." I have compared it with both *intestinalis* from Norway and cotypes of *verrilli* from the West Indies, and the difference in the tables is striking and apparently constant. I am satisfied that *verrilli* is a perfectly valid species and that the present Tahitian form is entirely distinct from either the European or the West Indian species.

Synallactes aenigma.

Plate 3, fig. 4.

Ludwig, 1893. Bull. M. C. Z., 24, p. 106 (*nomen nudum*). 1894, Mem. M. C. Z., 17, p. 26.

This seems to be one of the characteristic species of the Eastern Tropical Pacific and the present series throws no little light on its structure and variability. Instead of merely eviscerating, this species seems to have also the unusual habit of actually throwing off the skin. Either as a result of rough treatment in the trawl or because of the decreased pressure at the surface, or perhaps for both reasons, the skin, which is quite thick and tough splits down the middorsal

[1] *multiporus* = having many pores, in reference to the disk of the calcareous tables.

line and becomes entirely detached from the body-muscles, which are contracted into a firm cylindrical mass, evisceration having previously occurred. The skin around the mouth and the tentacles remain on the muscular mass.

The specimens at hand range from twenty-eight to nearly 100 mm. in length and show great diversity in the size, number and conspicuousness of the pedicels and papillae. The pedicels in the midventral radius may be so few and small, that they would readily escape notice but they may be fairly conspicuous. In one specimen there is scarcely a trace of dorsal papillae and even the marginal ones are indistinct, while in a slightly smaller specimen (Plate 3, fig. 4) from the same station, practically the whole dorsal surface is occupied by a double series of large conical papillae in each ambulacrum and a marginal series on each side.

In the larger of two specimens from station 4651, the calcareous ring is well developed and resembles that of *S. alexandri* as described by Ludwig, while in the smaller one, I fail to find any calcareous ring at all, the condition which Ludwig found in his specimens of *aenigma*. Even the calcareous tables show some diversity; in a specimen from 4656, the tables are rather slender and have a smooth spire while in another from the same station, the tables are stouter and have rough spires.

Probably many of the differences shown by preserved specimens, in form, size, and appearance of pedicels and papillae are artificial, but there can be little doubt that the species does show more or less diversity in nearly all its characters. There are also changes due to age which cannot be ignored. Young specimens have remarkably slender tables; the basal arms are very slender and the spire, about twice the basal diameter, is very long, slender, and thorny. Apparently with age, the spires become stouter and smoother as well as shorter, and the basal arms are noticeably thicker.

Station 4649. Eastern Tropical Pacific, 5° 17′ S., 85° 19′ 30″ W., 2,235 fms. Bott. temp. 35.4°. Fne. stky. gr. m.

Station 4651. Peru: west of Aguja Point, 111 miles. 2,222 fms. Bott. temp. 35.4°. Stky. fne. gy. s., trace of shore-mud.

Station 4656. Eastern Tropical Pacific, 6° 54′ 36″ S., 83° 34′ 18″ W., 2,222 fms. Bott. temp. 35.2°. Fne. gn. m., mang. nod.

Eight specimens.

Synallactes triplax,[1] sp. nov.

Plate 4, fig. 14–17.

Length, 60 mm.; diameter, less than 20 mm. Color, pale gray, nearly white. General appearance much as in *S. aenigma* but pedicels larger and

[1] τρίπλαξ = triple, in reference to the triradiate calcareous tables.

more conspicuous on ventral surface; there are two well-marked series in each of the three ventral ambulacra. In each of the dorsal ambulacra is a double row of conical papillae. Tentacles twenty, rather small. Calcareous ring very well developed; interradial pieces wider than high with a conspicuous anterior point; radial pieces much larger with a strongly concave posterior margin and two conspicuous, truncate anterior projections. No ampullae on the tentacles. Respiratory trees well developed. Genital glands in two tufts, one on each side of the dorsal mesentery. Anus terminal and not sunken in a vertical furrow.

Calcareous particles, crowded tables with simple spires (Plate 4, fig. 14) of three rods united by three cross-bars but with the points free, straight and parallel; disks triradiate, in the typical condition (Plate 4, fig. 15) with three large oval perforations and a second series of three somewhat smaller holes alternating with them; usually, however, a third, often a fourth and not rarely a fifth series of perforations is present (fig. 16); diameter of disk 150–500 μ, but usually 250–400; height of spire equals disk-diameter or somewhat less. In many of the larger tables, the primary perforations are never closed in distally, so the disk remains a triradiate plate (Plate 4, fig. 17), with the outer end of each bar dichotomously branched and the final expansion perforated with 1–4 holes.

Station 4642. Galapagos Islands: Hood Island, 4 miles southeast of Ripple Point. 300 fms. Bott. temp. 48.6°. Brk. sh., glob.

One specimen.

This species is notable for the relatively shallow water in which it lives and the high bottom temperature of its habitat. It is closely related to several of the recently described Japanese species of Synallactes, particularly to *discoidalis* Mitsukuri. It differs from this form, however, in having fewer papillae and pedicels; four rows of papillae instead of six, and only two series of midventral pedicels instead of four to six. The tables are larger than in *discoidalis*, in which species the disk is only about 175 μ across, and the spire is quite different, as the three rods composing it are more or less fused in the Japanese species.

Pseudostichopus mollis.

Théel, 1886. Challenger Hol., pt. 2, p. 169.

These specimens are 20–125 mm. in length and show the usual diversity of this species in the condition of the body-wall and its surface. Some are firm,

almost hard with a perfectly smooth surface, showing no pedicels or adherent particles; others are less firm and show numerous pedicels and more or less adherent foreign material; still others are soft and flaccid, often with so much adherent material as to obscure the pedicels. All agree, however, in the absence of calcareous particles in the skin and in the presence of the vertical groove for the anus. The species of Pseudostichopus are perplexing but I see no good reason why these specimens should not all be referred to *mollis*. The differences between them are almost certainly artificial, except such as are due to age.

Station 4641. Galapagos Islands: Hood Island, 12 miles southeast of Ripple Point. 633 fms. Bott. temp. 39.5°. Lt. gy. glob. oz.
Station 4647. Eastern Tropical Pacific, 4° 33′ S., 87° 42′ 30″ W., 2,005 fms. Bott. temp. 35.5°. Lt. gy. and br. glob. oz.
Station 4656. Eastern Tropical Pacific, 6° 54′ 36″ S., 83° 34′ 18″ W., 2,222 fms. Bott. temp. 35.2°. Fne. gn. m., mang. nod.
Station 4672. Peru: southwest of Palominos Light House, 88 miles. 2,845 fms. Bott. temp. 35.2°. Fne. dk. br. infus. m.

Twelve specimens.

Stichopus chloronotus.

Brandt, 1835. Prod. descr. Anim., p. 250.

A single specimen of this wide-spread Indopacific species was taken at Uola, Caroline Islands, February 15, 1900.

Stichopus variegatus.

Semper, 1868. Holothurien, p. 73.

It is a matter of no little interest that this well-known Indopacific species was found at Easter Island, December 21, 1904. The known range is thus extended many hundred miles to the southeastward. The specimen is a large one but strongly contracted.

Holothuria arenicola.

Semper, 1868. Holothurien, p. 81.

A single specimen about 80 mm. long was taken at Perico Island, Panama, October 26, 1904. The species was previously known from the Galapagos and its occurrence at Panama is therefore not surprising, but it is quite possible that comparison of good series from the East Indies, the Galapagos, and Panama will show specific differences not at present suspected. Fisher (1907, Proc. U. S. Nat. Mus., **32**, p. 664) has pointed out that the name *maculata* Brandt which has long priority over *arenicola*, is invalidated by *Holothuria maculata*

Chamisso and Eysenhardt, 1821. The fact needs emphasis, as Ludwig's very careful and important revision of Brandt's species has so generally validated Brandt's names.

Holothuria atra.

JAEGER, 1833. De Holothuriis, p. 22.

This very abundant species is represented in both the collections. It was taken at Rangiroa, Paumotu Islands, September 21, 1899 and at Manga Reva, Paumotu Islands, February 3, 1905. The latter would seem to be the farthest to the southeast that the species is known to range.

Three specimens.

Holothuria cinerascens.

Stichopus (Gymnochirota) cinerascens BRANDT, 1835. Prod. descr. Anim., p. 251.
Holothuria cinerascens LAMPERT, 1885. Die Seewalzen, p. 82.

A single specimen of this species, long known under Selenka's familiar name *pulchella*, was taken on the coral reef at Manga Reva, February 3, 1905. The record extends the known range far to the southeast.

Holothuria difficilis.

SEMPER, 1868. Holothurien, p. 92.

Fifteen small specimens which seems to be this species were taken at Makemo, Paumotu Islands, October 20, 1899. The resemblance in the general appearance and in the calcareous particles with those of *H. captiva*, *H. frequentiamensis*, and *Actinopyga parvula* are very striking, and suggest that the four names represent a single species. Examination of good series of specimens from numerous localities will be necessary to get the matter cleared up.

Holothuria imitans.

LUDWIG, 1875. Arb. Zool. Zoot. Inst. Wurzburg, **2**, p. 109.

There is a deep brown holothurian, 110 mm. long by 30 mm. in diameter, in the 1904–1905 collection labeled "11 4." I am unable to find any interpretation of this label for on November 4, if the figures are a date, the ALBATROSS was dredging in more than 1,700 fms. between Panama and the Galapagos, and the specimen is obviously a littoral form. The calcareous particles are tables alone, save for supporting rods in the numerous pedicels which cover the whole body. The tables are very different from those of *languens* and while they also differ from Ludwig's figure of the tables of *imitans*, they are so much

nearer the latter, I refer the specimen to that species, though not without some doubt. The tables have an annular disk with eight distinct spines, and a distinctly smaller top with twelve to twenty teeth; the rods composing the spire diverge basally, not converging as in *languens*.

Holothuria impatiens.

Fistularia impatiens Forskål, 1775. Desc. Anim., p. 121.
Holothuria impatiens Gmelin, 1788. Syst. Nat. Linn. ed. 13, p. 3,142.

This is another of the common wide-spread Indopacific species occurring in both collections. It was taken in the Paumotu Islands at Fakarava, October 12, 1899, and again at Makemo, October 20. On February 3, 1905, a specimen was found at Manga Reva, Paumotus, notable for its color, seal-brown with the papillae cream-color. The specimens are all much contracted. Four specimens.

Holothuria languens.

Selenka, 1867. Zeits. f. w. Zool., **17**, p. 335.

This well-known Panamic species is represented in the 1904–1905 collection by three specimens, 15–40 mm. long, all much contracted and in poor condition. Two are from Taboguilla Island, Panama, October 31, 1904, and the third was collected at Perico Island, Panama, October 26, 1904.

Holothuria leucospilota.

Stichopus (*Gymnochirota*) *leucospilota* Brandt, 1835. Prod. descr. Anim., p. 251.
Holothuria leucospilota Lampert, 1885. Die Seewalzen, p. 71.

This species, so long known under Selenka's familiar name, *vagabunda*, must unquestionably bear Brandt's much earlier name, though both Lampert and Théel refused to recognize such a change. Four specimens were taken during the voyage of 1899–1900, the localities being:—

Rangiroa, Paumotus, September 21, 1899.
Maketea, Paumotus, October 6, 1899.
Fakarava, Paumotus, October 2, 1899.
Ponape, Caroline Islands, February 12, 1900.

Holothuria lubrica.

Selenka, 1867. Zeits. f. w. Zool., **17**, p. 329.

This well-known Panamic species is represented in the 1904–1905 collection by five specimens. There is some diversity of color but the general shade is brown, darkest dorsally; in one specimen, blackish spots on the dorsal side

are fairly distinct. As a rule the distinction between the dorsal and ventral surfaces is very marked but this is not always the case. The specimens were taken at Taboquilla and Perico Islands, Panama, in October, 1904.

Holothuria marenzelleri.

Ludwig, 1883. Ber. d. oberh. Ges. f. Naturk., **22**, p. 167.

A single specimen was taken at Chatham Island, in the Galapagos, in January 1905. It measures 100 mm. in length by 35–40 mm. in diameter. The species has been recorded previously from the Galapagos Islands, although it was originally described from the East Indies.

Holothuria monocaria.

Lesson, 1830. Cent. Zool., p. 225.

The specimens which I refer (though not without hesitation) to this common species are quite young, one about 40 mm., the other only 11 mm. long. The larger is nearly white and is possibly from Tahiti but nothing is certain as to the locality beyond the fact that the specimen was collected by the 1899–1900 expedition. There are very few buttons in the skin and the tables show considerable diversity of form. The smaller specimen is also nearly white. It was taken October 12, 1899, at Fakarava, Paumotu Islands. The tables are well formed but diversified with eight to thirteen marginal holes in the disk. There are apparently *no* buttons in the skin. If these specimens really are *monocaria* it would seem to be probable that tables arise some time before buttons and that the buttons only gradually become so numerous as to form the layer present in adults. But of course, only a series of indubitable growth-stages can determine whether this is the case.

Holothuria pardalis.

Selenka, 1867. Zeits. f. w. Zool., **17**, p. 336.

A single specimen taken October 20, 1899 at Makemo, Paumotu Islands, seems to belong to this species but the condition is poor and the calcareous particles are so corroded that it is impossible to be sure of the identification.

Holothuria scabra.

Jaeger, 1833. De Holothuriis, p. 23.

A single specimen of moderate size was taken at Guam, Ladrone Islands, February 27, 1900.

Actinopyga lecanora.

Mülleria lecanora Jaeger, 1833. De Holothuriis, p. 18.
Actinopyga lecanora Bronn, 1860. Thierreich, **3**, p. 403.

A specimen of this wide-spread Indopacific species was taken February 3, 1905, at Manga Reva, Paumotu Islands, on the coral reef, thus extending the known range far to the southeastward. The specimen is now very strongly contracted but the specific characters are distinguishable without difficulty.

Actinopyga mauritiana.

Mülleria mauritiana Quoy et Gaimard, 1833. Astrolabe Zooph., p. 138.
Actinopyga mauritiana Fisher, 1907. Proc. U. S. Nat. Mus., **32**, p. 618.

It is rather remarkable that while the 1899–1900 expedition brought home six specimens of this well-known species from at least four islands in the Society and Paumotu groups, the species was apparently not met with by the later expedition, although the latter took the preceding species at Manga Reva. The specimens are chiefly large adults but the one from Fakarava is only 20 mm. long and one from Papeete is less than half grown. The latter is notable for being colored like *lecanora*, the area around the anus being abruptly and conspicuously lighter than the ground-color of the body. The smallest specimen is of unusual interest because there are few grains in the ventral skin and the rods there are larger than those of the dorsal surface. If the identification of this specimen is correct, the characteristic ventral grains do not appear until the animal is more than 20 mm. long. No doubt the growth-stages of this Actinopyga would afford a very interesting study. The specimens in the present collection were taken at:—

Rangiroa, Paumotus, September 23, 1899.
Papeete, Tahiti, Society Islands, September 28, 1899.
Makatea, Paumotus, October 6, 1899.
Fakarava, Paumotus, October 12, 1899.

Actinopyga parvula.

Mülleria parvula Selenka, 1867. Zeits. f. w. Zool., **17**, p. 314.
Actinopyga parvula Fisher, 1907. Proc. U. S. Nat. Mus., **32**, p. 645.

There are sixteen small specimens 15–35 mm. long, collected at Easter Island, December 20, 1904, which seem to belong to this remarkably wide-spread species. The color ranges from brown to almost black dorsally, but is generally lighter ventrally. Some specimens show distinct blotches of darker color on the back. All the specimens have anal teeth but all five teeth are not equally developed in every case. This little holothurian is certainly a puzzle. It

occurs in the West Indian region where *Holothuria captiva*, from which it can scarcely be distinguished except by the anal teeth, is common. It occurs in the Indopacific region with *Holothuria difficilis* from which again the anal teeth are its one distinguishing character. On the other hand, it is utterly unlike any other Actinopyga save for the presence of the anal teeth. Pearsons is almost certainly right in removing it from Actinopyga but he throws no light on the problem of its relation to the species of Holothuria mentioned. Possibly the presence of anal teeth is, in this case, not even a valid specific character but it is hard to believe this is the case. At any rate, the occurrence of this perplexing form, originally described from Florida, on the shores of Easter Island is a matter of unusual interest.

Summary of the Echinoderms collected by the Agassiz-Albatross Tropical Pacific Expeditions of 1891, 1899–1900 and 1904–1905.

As the present report is the last of those dealing with the Echinoderms collected by Mr. Agassiz on his Tropical Pacific Expeditions, it is fitting that the chief additions to our knowledge of the taxonomy of the Echinodermata should be summarized.

The Crinoids proved to be the least abundant of the five classes and only *nine* species were taken. Of these *two* were unidentifiable but *six* of the others were new. There is no record of the number of specimens. The most notable of the crinoids are the two stalked forms *Bathycrinus equatorialis* A. H. Clark and *Calamocrinus diomedae* A. Agassiz. The latter, one of the most notable stalked crinoids as yet taken, was made the subject of a detailed monograph (Agassiz, 1892, Mem. M. C. Z. 17, no. 2).

The Asteroids were fairly numerous but there were few species of extraordinary interest. In all more than 1,300 specimens were brought home, representing *ninety* species, of which *sixty-nine* were new. Of new genera, *five* were established. The most notable forms are probably the two species of the new genus Albatrossia, the numerous species of Hymenaster, and Zoroaster, and the Brisingidae.

The Ophiurans were numerous both in specimens and species but unfortunately there is no complete record of the number of specimens. There were at least *ninety-seven* species taken, and of these *sixty* were new. One new genus was described based on this material. The most noteworthy brittle-stars are *Gymnophiura mollis*, *Sigsbeia lineata*, and *Ophioderma pentacantha*.

The ECHINI were represented by *forty* species, a very large number in proportion to the total number of species known. There is no means of determining how many specimens were taken as there are no available records on this point. *Ten* of the species brought home are common littoral species of wide range but of the other *thirty*, no fewer than *twenty-nine* were new when taken and all but one of these is from deep water. Undoubtedly the most remarkable sea-urchin discovered is *Pilematechinus rathbuni*, but *Centrocidaris doederleini*, *Dialithocidaris gemmifera*, *Plexechinus cinctus*, and *Phryssocystis aculeata* are also of exceptional interest, each being the type of a new genus.

The HOLOTHURIANS were the most generally met with of any of the classes of echinoderms and the records show that 953 were in the collections brought home. These represented *seventy-nine* different species many of which are common littoral forms of wide range but *forty-three* were described as new. Of course the most remarkable is the extraordinary *Pelagothuria natatrix*, sole representative of a pelagic family and the only echinoderm known to be truly pelagic in adult life. Other noteworthy holothurians, knowledge of which we owe to these explorations of the ALBATROSS, are two abyssal species of Myriotrochus, the huge *Psychropotes raripes*, *Laetmophasma fecundum*, *Capheira sulcata*, and *Echinocucumis hitentaculata*.

Summing up for the five classes, we find that the ALBATROSS, on her three Tropical Pacific expeditions, collected several thousand echinoderms, representing 315 species, of which 207, or more than two thirds, were new. The increase in our knowledge of the morphology and distribution, both geographical and bathymetrical, of the group, which we owe to these expeditions, cannot be summarized in this rough and ready way, but one cannot turn the pages of the following reports, wherein they are treated, without realizing how great it is.

List of the Reports based wholly or in part on the Echinoderms collected by the ALBATROSS *Tropical Pacific Expeditions in 1891, 1899–1900, and in 1904–1905*

CRINOIDS.

A. Agassiz, 1892. Mem. M. C. Z., **17**, no. 2, p. 1–95, pl. 1–32.

C. Hartlaub, 1895. Bull. M. C. Z., **27**, p. 127–152, pl. 1–4.

A. H. Clark, 1908. Bull. M. C. Z., **51**, p. 231–248, pl. 1, 2.

ASTEROIDS.

H. Ludwig, 1905. Mem. M. C. Z., **32**, 304 pp., pl. 1–36.

H. Ludwig, 1907. Zool. anz., **31**, p. 312–319.

H. L. Clark, 1920. Mem. M. C. Z., **39**, p. 69–114, pl. 1–6.

Ophiurans.

C. F. Lütken and T. Mortensen, 1899. Mem. M. C. Z., **23**, p. 93–207, pl. 1–23.

H. L. Clark, 1917. Bull. M. C. Z., **61**, p. 427–453, pl. 1–5.

Echini.

A. Agassiz, 1898. Bull. M. C. Z., **32**, p. 69–86, 14 pls.

A. Agassiz, 1904. Mem. M. C. Z., **31**, 253 pp., 112 pls.

A. Agassiz and H. L. Clark, 1907–1909. Mem. M. C. Z., **34**, 210 pp., pl. 1–89.

A. Agassiz, 1908. Mem. M. C. Z., **39**, p. 1–34, 49 pls.

A. M. Westergren, 1911. Mem. M. C. Z., **39**, p. 35–68, pl. 1–38.

H. L. Clark, 1912. Mem. M. C. Z., **34**, p. 205–383, pl. 90–121.

H. L. Clark, 1914–1917. Mem. M. C. Z., **46**, p. 1–283, pl. 122–161.

Holothurians.

H. Ludwig, 1893. Zool. anz., **16**, p. 177–186. Bull. M. C. Z., **24**, p. 103–114.

H. Ludwig, 1894. Mem. M. C. Z. **17**, no. 3, p. 1–183, pl. 1–19.

H. L. Clark, 1920. Mem. M. C. Z., **39**, p. 115–154, pl. 1–4.

EXPLANATION OF THE PLATES.

PLATE 1.

PLATE 1.

1. **Psychropotes raripes** Ludwig.
   Large adult from Station 4721, seen from the side. About one half natural size.

2. **Euphronides verrucosa** Ludwig.
   Large adult from Station 4742, seen from above. About two thirds natural size.

A. Agassiz and A.M. Westergren del.

PLATE 2.

PLATE 2.

1. **Benthodytes glutinosa** R. Perrier.
   Adult from Station 4647, seen from below.

2. **Benthodytes regularis** H. L. Clark.
   Holotype from Station 4649, seen from above.

3. **Euphronides dyscrita** H. L. Clark.
   Adult, probably the holotype, from Station 4672, seen from above.

4. **Periamma tetramerum** H. L. Clark.
   Adult from Station 4670, seen from below.

5. **Cucumaria abyssorum** Théel.
   Adult from Station 4649, seen from the side, the ventral surface to the left.

All figures supposed to be natural size.

A Agassiz and A.M. Westergren del.

PLATE 3.

PLATE 3.

1. **Molpadia holothurioides** Cuvier?
   Adult from Station 4672, seen from the side. The absence of a caudal appendage is perhaps due to an accident.

2. **Molpadia bathybia** H. L. Clark.
   Paratype from Station 4670, seen from below.

3. **Parelpidia anamesa** H. L. Clark.
   Holotype from Station 4658, seen from below.

4. **Synallactes aenigma** Ludwig.
   Adult from Station 4649; the discarded and contracted skin seen from above.

5. **Molpadia** sp.
   Drawn from a specimen, no longer extant, taken at Station 4630.

6. **Scotoplanes murrayi** (Théel).
   Adult from Station 4651, seen from above.

All figures supposed to be natural size.

A. Agassiz del. & A. M. Westergren lith.

PLATE 4.

PLATE 4.

1, 2. **Chiridota aponocrita** H. L. Clark.
1. Supporting-rods of tentacles. × 450.
2. Miliary granules. × 450.

3. **Myriotrochus bathybius** H. L. Clark.
Calcareous wheel. × 95.

4. **Myriotrochus giganteus** H. L. Clark.
Calcareous wheel. × 95.

5, 6. **Molpadia bathybia** H. L. Clark.
Disks of tables. × 95.
Spire of a table, from the side. × 95.

7, 8. **Scotodeima parvispiculatum** H. L. Clark.
Calcareous particles. × 140.

9, 10. **Mesothuria megapoda** H. L. Clark.
9. Table, seen from the side. × 95.
10. Disk of table. × 95.

11–13. **Mesothuria multipora** H. L. Clark.
11. Table, seen from the side. × 95.
12. Disk of table. × 95.
13. Spire of table, seen from above. × 95.

14–17. **Synallactes triplax** H. L. Clark.
14. Typical table seen from the side. × 95.
15. Disk of typical triradiate table. × 95.
16. Disk of larger table. × 95.
17. Disk of an "unclosed" table. × 95.

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